

# **Report as of FY2008 for 2008PA85B: "Mercury in Pennsylvania Forest Streams: Do Hotspots Exist?"**

## **Publications**

- Conference Proceedings:
  - ◆ Sebestyen SD, JB Shanley, and EW Boyer (2009). Documenting effects of atmospheric pollutants on stream chemistry using high-frequency sampling. In press, Proceedings of the Third Interagency Conference on Research in the Watersheds.

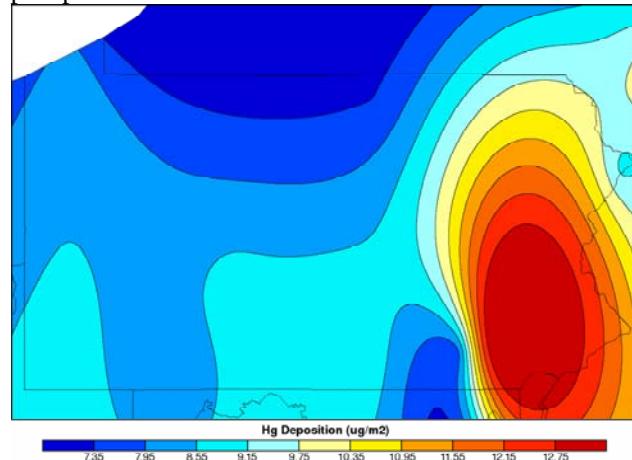
## **Report Follows**

## PRINCIPAL FINDINGS AND SIGNIFICANCE

Mercury is a persistent element in the environment that has the ability to bioaccumulate and biomagnify up the food chain, with potentially harmful effects for human health and ecosystems. Mercury emissions to the atmosphere are the largest source of mercury pollution globally and in most areas of the northeastern USA. Concern for increased environmental Hg levels and effects led to the development of a Mercury Deposition Network (MDN) that is operated by the National Atmospheric Deposition Program, which provides monitoring of mercury in precipitation at sites across the US and southern Canada. The Pennsylvania Water Resources Research Institute contributes to the operation of the 9 mercury deposition monitoring sites in the state. Results from the MDN monitoring show that Pennsylvania receives among the highest rates of Hg deposition of any location in the northeastern USA, experiencing wet atmospheric deposition rates of 7-10  $\mu\text{g Hg}/\text{m}^2$  in precipitation in 2006. Watersheds in Pennsylvania receive mercury that is emitted from the smokestacks of coal-fired power plants and other sources then is deposited to the landscape. Some mercury runs off into nearby streams where it can accumulate in the sediments and biota. Human exposure to Hg occurs mostly through fish consumption, and currently fish eating advisories due to mercury have been posted for over 877 stream miles and 28 lakes (28,500 acres) across Pennsylvania. Stream Hg levels are believed to be a key indicator for concentrations of mercury available for uptake by biological organisms.

In this project, baseline data on mercury accumulation was collected from 40 forested watersheds throughout the state, spanning gradients of climate and geology. These watersheds are minimally disturbed (e.g., no direct impacts of agriculture, urbanization, or mining) and are able to support fish populations. Mercury was measured in stream water, fish tissue (from brook trout), aquatic mosses, and in stream-

Measurement-interpolated atmospheric deposition of mercury in precipitation in PA for 2007



CMAQ-simulated total mercury deposition for 2001  
(micrograms persquare meter)

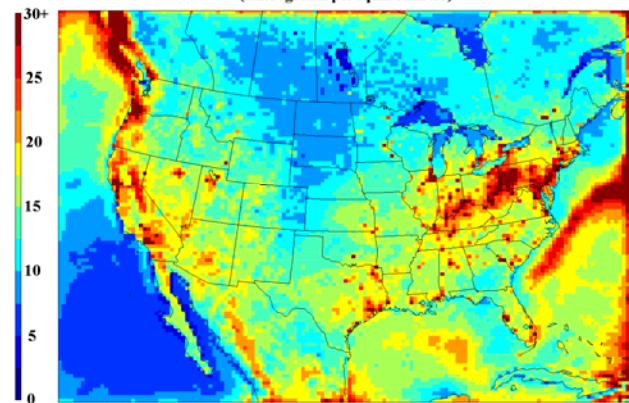


Figure 1. (top:) Wet Hg deposition from interpolation of measurement data across PA in 2007 based on an interpolation of data from monitoring sites in PA & surrounding states. (bottom): Modeled total (wet+dry) total Hg deposition with the CMAQ model for the USA in 2001 (from US EPA).

bed sediments. Preliminary data suggest that mercury is accumulating at trace levels in these aquatic environments. Highest concentrations were found in the mosses and sediments, suggesting their potential utility for integrating long term watershed responses. Mercury levels in fish samples are very low in concentration with respect to human health concerns. However, mercury levels in fish samples suggest potential ecosystem level concerns in some of the watersheds, with concentrations in fish approaching the US Fish and Wildlife Service fish-eating bird and wildlife advisory. The findings of this study suggest that mercury deposition is reaching remote watersheds all across the state and is affecting aquatic ecosystems.

